



Operations

Compost Operators Training Certificate Course

Operations





Operations

References

United States Composting Council

**Recommend Commercial Composting and Compost Use 40-hour advanced course*

The Practical Handbook of Compost Engineering

Haug

Michigan Compost Operator Training Guidebook



Operations

Outline

- 1. Composting Processes**
- 2. Composting Systems and Technologies**
- 3. Process Monitoring and Control**
- 4. Health and Safety**
- 5. Equipment Selection and Maintenance**
- 6. Staffing**
- 7. Site Selection and Community Relations**



Operations

Composting Processes



Operations

Composting Processes

- 1. Feedstock Characterization**
- 2. Pre-Processing**
- 3. Active Composting**
- 4. Compost Curing**
- 5. Screening**
- 6. Odor Control**





Operations

Potential sources include

- ❖ Yard trimmings
- ❖ Land clearing debris
- ❖ Food scraps
- ❖ Storm debris
- ❖ Biosolids, sludges and greases
- ❖ Animal manures
- ❖ Animal mortalities
- ❖ Agricultural wastes
- ❖ Wood wastes (e.g., pallets)
- ❖ Sheetrock

Know your Waste!



Yardwaste to Compost



WeCare[®]





Operations

Material Acceptance

- ❖ **Transportation/ Delivery**
 - ❖ Local (curbside)
 - ❖ Commercial (large volumes at once)
 - ❖ Container type (additional handling)
- ❖ **State of Material**
 - ❖ Volume vs. mass (packed trucks!)
 - ❖ Bags (odor and pre-processing issues)
 - ❖ Old (wet and odorous)





Operations

Feedstock Characterization

❖ Quantities

- ❖ Mass/ volume per day (solids and liquids)**

❖ Properties

- ❖ Bulk density (weight per unit volume)**
- ❖ Moisture content**
- ❖ Nutrients (C&N, also P and micronutrients)**
- ❖ Contaminants**

❖ Develop appropriate feedstock ‘recipes’

❖ Seasonal Variations

- ❖ Grass (spring) vs. leaves (fall)**



Operations

Recipe Development

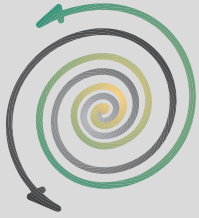
- ❖ **Characteristics of materials added to a mixture can aid or inhibit the decomposition process, aeration, microbial growth and odor production**
- ❖ **A mix of too high carbon will decompose at a slow rate and a mix high in nitrogen runs the risk of generating odors**
- ❖ **Seasonal generation patterns require that leaves be accumulated on-site in the fall for mixing**
- ❖ **Keep a careful watch on anaerobic materials and anaerobic conditions**



Operations

Design Criteria

- ❖ **Air (oxygen, no less than 5%)**
- ❖ **Moisture (40-60%)**
- ❖ **Particle size (less than 2 inches)**
- ❖ **Porosity (free air space of >35%)**
- ❖ **C:N ratio (30:1 or less)**
- ❖ **pH between 6.5 and 8.0**
- ❖ **Temperature (70-150°F: meso to thermo)**
- ❖ **Bulk Density - lbs/cy (varies per waste)**



Operations

| Material Composition | Nitrogen (dry weight) (%) | C:N (dry weight) | Moisture Content (average %) | Bulk Density @ Moisture Content (lbs/cy) |
|----------------------|---------------------------|------------------|------------------------------|--|
| Food Waste | 3.1% | 15:1 | 70% | 600 lbs/CY |
| Yard Waste | 2.5% | 20:1 | 10 to 50% | 350 lbs/CY |
| Vegetable Waste | 3.5% | 12:1 | 70% | 550 lbs/CY |
| Fruit Waste | 1.4% | 40:1 | 80% | 800 lbs/CY |
| Coffee Grounds | 3.0% | 20:1 | 70% | 600 lbs/CY |
| Tea Bags/Leaves | 1.0% | 70:1 | 70% | 550 lbs/CY |
| Leaves | 0.9% | 60:1 | 40% | 300 lbs/CY |
| Brush | 2.0% | 35:1 | 15 to 70% | 400 lbs/CY |
| Grass | 3.4% | 15:1 | 80% | 500 lbs/CY |
| Wood Chips | 0.1% | 600:1 | 50% | 400 lbs/CY |
| Sawdust | 0.2% | 500:1 | 40% | 400 lbs/CY |
| Soiled Paper | 0.2% | 150:1 | 20% | 250 lbs/CY |
| Corrugated Cardboard | 0.1% | 550:1 | 8% | 100 lbs/CY |

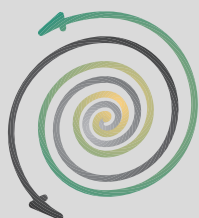


Operations

Recipe Example

❖ Seasonal Yard Waste (brush/grass), poultry litter, clearing debris, leaves

| | | | | |
|-----------------------------|--|---------------|-------------|---------------|
| Seasonal YW Quantities: | 12,000 "customers" x 2.6 persons/household = 31,200 persons 31,200 persons x 0.1 tons/person/year = 3,120 tons/year of YW | | | |
| | <u>Spring</u> | <u>Summer</u> | <u>Fall</u> | <u>Winter</u> |
| Seasonal Quantity Distr. | 40% | 20% | 30% | 10% |
| Quantity per season (tons): | 1248 | 624 | 936 | 312 |
| Quantity per month (tons): | 416 | 208 | 312 | 104 |
| Quantity per week (tons): | 104 | 52 | 78 | 26 |
| Seasonal Distributions: | <u>Spring</u> | <u>Summer</u> | <u>Fall</u> | <u>Winter</u> |
| Grass Clippings | 35% | 25% | 10% | 0% |
| Brushy Yard Waste | 65% | 75% | 40% | 80% |
| Leaves | 0% | 0% | 50% | 20% |

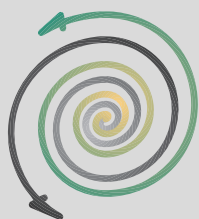


Operations

MIX RATIO CALCULATIONS - Spring
Example Weekly Recipe

Recipe Example (Spring)

| INGREDIENTS | Poultry Litter | Brushy Yard Wastes | Grass Clippings | Leaves (Freshly fallen) | Vegetative Clearing Debris | TOTAL MIX TARGET |
|--------------------------|----------------|--------------------|-----------------|-------------------------|----------------------------|------------------------|
| C (% AS IS) | 37.8 | 53.0 | 41.0 | 37.3 | 33.8 | |
| N (% AS IS) | 2.7 | 1.0 | 3.0 | 1.5 | 1.1 | |
| MOISTURE% | 37 | 42.5 | 80.0 | 54.1 | 57.5 | |
| UNITS IN MIX BY WGT (T) | 10 | 68 | 36 | 0 | 45 | 159 |
| UNITS IN MIX BY WGT (LB) | 20,000 | 136,000 | 72,000 | 0 | 90,000 | 318,000 |
| UNITS IN MIX BY VOL (CY) | 13 | 272 | 144 | 0 | 129 | 557 |
| DENSITY (LBS/CY) | 1600 | 500 | 500 | 200 | 700 | |
| RELATIVE DENSITY | 1.00 | 0.31 | 0.31 | 0.13 | 0.44 | |
| | 20000.00 | 136000.00 | 72000.00 | 0.00 | 90000.00 | |
| POUNDS OF CARBON | 7,560 | 72,080 | 29,520 | 0 | 30,420 | 139,580 |
| POUNDS OF NITROGEN | 540 | 1,360 | 2,160 | 0 | 990 | 5,050 |
| C:N RATIO | 14.00 | 53.00 | 13.67 | 24.87 | 30.73 | 27.64 20 TO 30 |
| POUNDS OF MOISTURE | 7,400 | 57,800 | 57,600 | 0 | 51,750 | 174,550 |
| NUMBER OF UNITS | 20,000 | 136,000 | 72,000 | 0 | 90,000 | 318,000 |
| PERCENT MOISTURE | | | | | | 54.89 50 TO 65% |



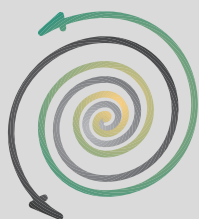
Operations

MIX RATIO CALCULATIONS - Summer

Example Weekly Recipe

Recipe Example (Summer)

| INGREDIENTS | Poultry Litter | Brushy Yard Wastes | Grass Clippings | Leaves (Freshly fallen) | Vegetative Clearing Debris | TOTAL MIX TARGET |
|--------------------------|----------------|--------------------|-----------------|-------------------------|----------------------------|------------------------|
| C (% AS IS) | 37.8 | 53.0 | 41.0 | 37.3 | 33.8 | |
| N (% AS IS) | 2.7 | 1.0 | 3.0 | 1.5 | 1.1 | |
| MOISTURE% | 37 | 42.5 | 80.0 | 54.1 | 57.5 | |
| UNITS IN MIX BY WGT (T) | 20 | 39 | 13 | 0 | 45 | 117 |
| UNITS IN MIX BY WGT (LB) | 40,000 | 78,000 | 26,000 | 0 | 90,000 | 234,000 |
| UNITS IN MIX BY VOL (CY) | 25 | 156 | 52 | 0 | 129 | 362 |
| DENSITY (LBS/CY) | 1600 | 500 | 500 | 200 | 700 | |
| RELATIVE DENSITY | 1.00 | 0.31 | 0.31 | 0.13 | 0.44 | |
| | 40000.00 | 78000.00 | 26000.00 | 0.00 | 90000.00 | |
| POUNDS OF CARBON | 15,120 | 41,340 | 10,660 | 0 | 30,420 | 97,540 |
| POUNDS OF NITROGEN | 1,080 | 780 | 780 | 0 | 990 | 3,630 |
| C:N RATIO | 14.00 | 53.00 | 13.67 | 24.87 | 30.73 | 26.87 20 TO 30 |
| POUNDS OF MOISTURE | 14,800 | 33,150 | 20,800 | 0 | 51,750 | 120,500 |
| NUMBER OF UNITS | 40,000 | 78,000 | 26,000 | 0 | 90,000 | 234,000 |
| PERCENT MOISTURE | | | | | | 51.50 50 TO 65% |



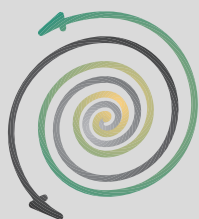
Operations

MIX RATIO CALCULATIONS - Fall

Example Weekly Recipe

Recipe Example (Fall)

| INGREDIENTS | Poultry Litter | Brushy Yard Wastes | Grass Clippings | Leaves (Freshly fallen) | Vegetative Clearing Debris | TOTAL MIX TARGET |
|--------------------------|----------------|--------------------|-----------------|-------------------------|----------------------------|------------------------|
| C (% AS IS) | 37.8 | 53.0 | 41.0 | 37.3 | 33.8 | |
| N (% AS IS) | 2.7 | 1.0 | 3.0 | 1.5 | 1.1 | |
| MOISTURE% | 37 | 42.5 | 80.0 | 54.1 | 57.5 | |
| UNITS IN MIX BY WGT (T) | 20 | 31 | 8 | 39 | 45 | 143 |
| UNITS IN MIX BY WGT (LB) | 40,000 | 62,000 | 16,000 | 78,000 | 90,000 | 286,000 |
| UNITS IN MIX BY VOL (CY) | 25 | 124 | 32 | 390 | 129 | 700 |
| DENSITY (LBS/CY) | 1600 | 500 | 500 | 200 | 700 | |
| RELATIVE DENSITY | 1.00 | 0.31 | 0.31 | 0.13 | 0.44 | |
| | 40000.00 | 62000.00 | 16000.00 | 78000.00 | 90000.00 | |
| POUNDS OF CARBON | 15,120 | 32,860 | 6,560 | 29,094 | 30,420 | 114,054 |
| POUNDS OF NITROGEN | 1,080 | 620 | 480 | 1,170 | 990 | 4,340 |
| C:N RATIO | 14.00 | 53.00 | 13.67 | 24.87 | 30.73 | 26.28 20 TO 30 |
| POUNDS OF MOISTURE | 14,800 | 26,350 | 12,800 | 42,198 | 51,750 | 147,898 |
| NUMBER OF UNITS | 40,000 | 62,000 | 16,000 | 78,000 | 90,000 | 286,000 |
| PERCENT MOISTURE | | | | | | 51.71 50 TO 65% |



Operations

MIX RATIO CALCULATIONS - Winter

Example Weekly Recipe

Recipe Example (Winter)

| INGREDIENTS | Poultry Litter | Brushy Yard Wastes | Grass Clippings | Leaves (Freshly fallen) | Vegetative Clearing Debris | TOTAL MIX TARGET |
|--------------------------|----------------|--------------------|-----------------|-------------------------|----------------------------|------------------------|
| C (% AS IS) | 37.8 | 53.0 | 41.0 | 37.3 | 33.8 | |
| N (% AS IS) | 2.7 | 1.0 | 3.0 | 1.5 | 1.1 | |
| MOISTURE% | 37 | 42.5 | 80.0 | 54.1 | 57.5 | |
| UNITS IN MIX BY WGT (T) | 20 | 21 | 0 | 5 | 25 | 71 |
| UNITS IN MIX BY WGT (LB) | 40,000 | 42,000 | 0 | 10,000 | 50,000 | 142,000 |
| UNITS IN MIX BY VOL (CY) | 25 | 84 | 0 | 50 | 71 | 230 |
| DENSITY (LBS/CY) | 1600 | 500 | 500 | 200 | 700 | |
| RELATIVE DENSITY | 1.00 | 0.31 | 0.31 | 0.13 | 0.44 | |
| | 40000.00 | 42000.00 | 0.00 | 10000.00 | 50000.00 | |
| POUNDS OF CARBON | 15,120 | 22,260 | 0 | 3,730 | 16,900 | 58,010 |
| POUNDS OF NITROGEN | 1,080 | 420 | 0 | 150 | 550 | 2,200 |
| C:N RATIO | 14.00 | 53.00 | 13.67 | 24.87 | 30.73 | 26.37 20 TO 30 |
| POUNDS OF MOISTURE | 14,800 | 17,850 | 0 | 5,410 | 28,750 | 66,810 |
| NUMBER OF UNITS | 40,000 | 42,000 | 0 | 10,000 | 50,000 | 142,000 |
| PERCENT MOISTURE | | | | | | 47.05 50 TO 65% |



Operations

Pre-Processing

❖ Recovery

- ❖ Remove physical contaminants
- ❖ Protect equipment from damage
- ❖ Easier to remove at front end

❖ Preparation

- ❖ Optimize particle size for efficient composting
- ❖ Prepare for mixing
- ❖ Inoculum (compost recycle)



Operations

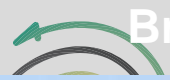
Pre-Processing

❖ Grinding

- ❖ Breakdown large amendments (tree limbs)
- ❖ Obtain desired particle size
- ❖ Stockpile!

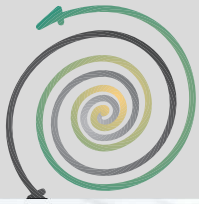
❖ Mixing

- ❖ Combine recipe ingredients
- ❖ Bulking agent (wood) needed with wetter feedstocks
- ❖ Complete and homogenous mixing is best
- ❖ Moisten



Brush and Wood Waste Tub Grinding to Mulch





Doppstadt Used for Yardwaste Processing *Operations*





Doppstadt Used for Yardwaste Processing

Operations





Operations

Active Composting

- ❖ **Design criteria**
- ❖ **Biological process ~30+ days**
- ❖ **Objectives**
 - ❖ **Degradation/ stabilization of organic matter**
 - ❖ **Pathogen destruction**
 - ❖ **Seed destruction**
 - ❖ **Remove odor potential**
- ❖ **Process control**
 - ❖ **Porosity, oxygen level, moisture**
 - ❖ **Microbial diversity by temperature control**



Operations

Changes in Compost Piles

- ❖ Mix of raw materials becomes more uniform and less bio-active
- ❖ Color turns brown to black
- ❖ Volume reduction of 25% to 50%
- ❖ Weight loss of 40% to 80%
- ❖ Some loss of N as ammonia
- ❖ C:N ratio declines



Operations

Curing

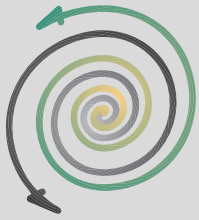
- ❖ **Once composted material is stable, but not mature**
 - ❖ **Stability = stage of decomposition**
 - ❖ **Maturity = biochemical state of the compost**
- ❖ **Maturing removes potentially phytotoxic intermediate compounds of decomposition**
- ❖ **Extent of curing defined by market**
 - ❖ **Overwintering ag fields – little curing**
 - ❖ **Horticultural uses – full curing**
- ❖ **Time: 30 – 60+ days**



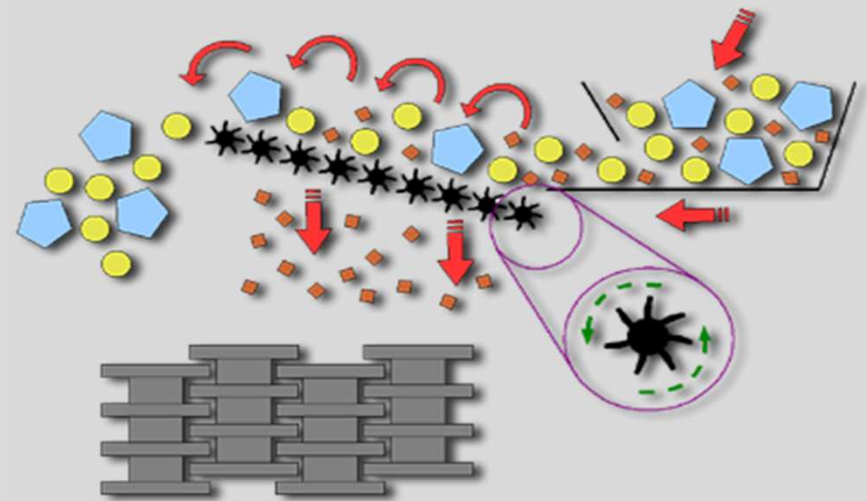
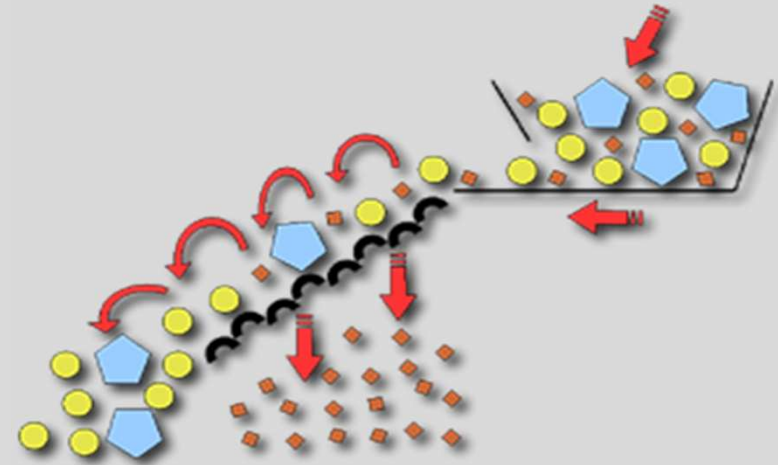
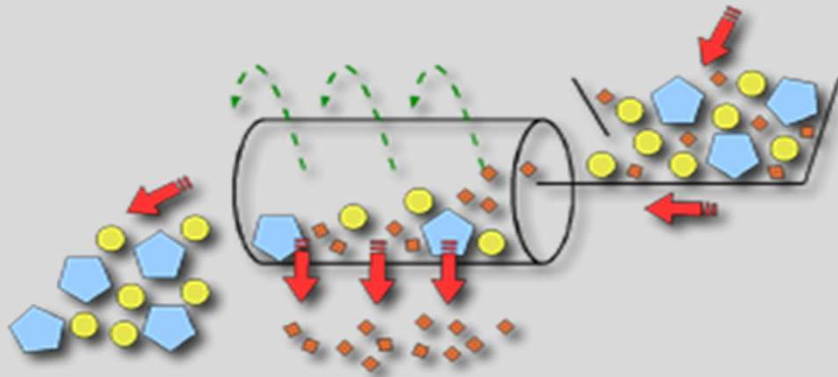
Operations

Screening

- ❖ Equipment used to remove 'large' particles from finished compost before it is sold
- ❖ Screen size (e.g., 1/4", 3/8", 1") vary on what the market for that material is
 - ❖ Golf course = smaller size
 - ❖ Road construction = larger size
- ❖ Types
 - ❖ Trommel Screen
 - ❖ Shaker deck
 - ❖ Star screen



Operations





Operations

Odor Control

- ❖ **Chemical compounds emitted as a gas, inhaled and sensed by the human nose**
- ❖ **Odor quantification**
 - ❖ **Concentration**
 - ❖ **Intensity**
 - ❖ **Persistence**
 - ❖ **Character**
 - ❖ **Hedonic tone (pleasantness, or lack of)**
- ❖ **Determine odor concentration**



Operations

Odor Control

- ❖ **Most released in first 14 days and after turning/ material movement**
- ❖ **Perform odor modeling for site layout/ mitigation**
- ❖ **Implement odor treatment technologies**
 - ❖ **Biofiltration**
 - ❖ **Windrow covers**
 - ❖ **Chemical scrubbers**
 - ❖ **Masking agents**
 - ❖ **“Neutralizers”/ counteractants**
 - ❖ **Electric field/ ozone generators**



Operations

Odor Control

❖ Common Odors and Cause

- ❖ Ammonia = Too much nitrogen
- ❖ Amines (fishy) = Anaerobic conditions
- ❖ Sulfides (rotten egg) = Anaerobic conditions
- ❖ Volatile Fatty Acids, VFAs (gym bag) = Anaerobic conditions

❖ Factors to Consider

- ❖ Composting rate/ size
- ❖ Moisture
- ❖ Aeration and turning
- ❖ Recipe
- ❖ Weather conditions
- ❖ Time of day
- ❖ Season





Operations

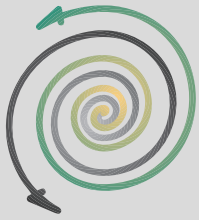
Composting Systems and Technologies



Operations

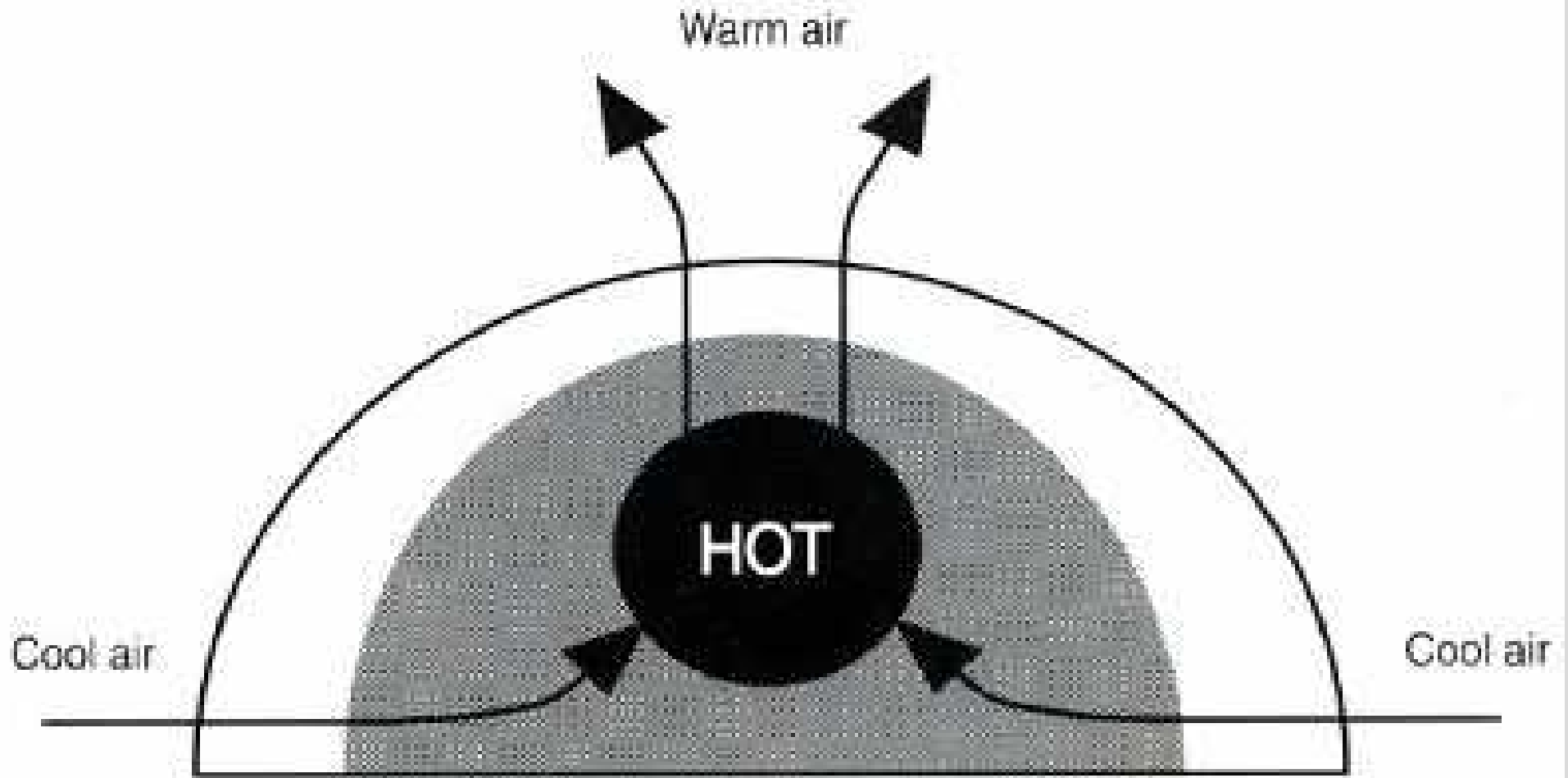
Compost Methods

- 1. Turned Windrows**
- 2. Passive aerated windrows**
- 3. Aerated static pile**
- 4. In-vessel composting**



Operations

'Chimney Effect'





Operations

Turned Windrows

- ❖ **Mixed materials placed in windrows which are agitated or turned**
 - ❖ **Various shapes**
- ❖ **Windrows aerate by passive air movement (chimney effect)**
- ❖ **Turning vital**
 - ❖ **Rebuilds porosity**
 - ❖ **Releases trapped heat, water and gases**
 - ❖ **Exchanges surface with interior materials**
- ❖ **Windrow Management**
 - ❖ **Important to maintain turning schedule (temp and odor control)**







Operations

Passive Aerated Windrows

- ❖ **Eliminates need for turning by supplying air to the materials through perforated pipes embedded in each windrow (hot gases rise upward out of the windrow)**
- ❖ **No turning or agitation of the materials occurs once the pile is formed**
- ❖ **Good for odorous feedstocks (i.e., fish waste)**





Operations

Aerated Static Pile

- ❖ Takes the piped aeration system a step further, using a blower to supply air to the materials
- ❖ No turning or agitation of the materials occurs once the pile is formed
- ❖ Can be positive or negative pressure air, depending on facility specifications
- ❖ Good for biosolids



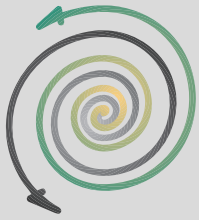


Operations

In-Vessel

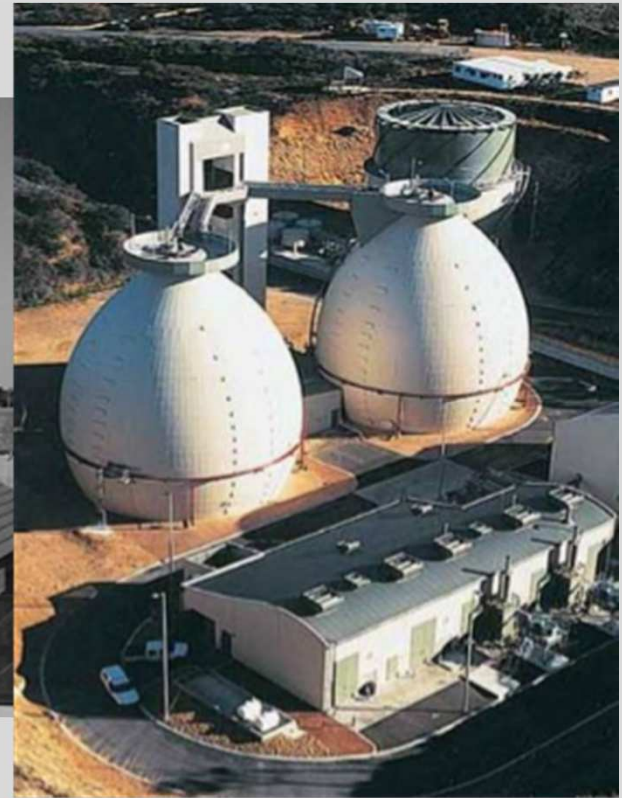
- ❖ **Confine the materials within a building, container, or vessel**
- ❖ **Rely on a variety of forced aeration and mechanical turning techniques to speed up the process**
- ❖ **Bin composting, rectangular agitated beds, silos, rotating drums**





Operations

Anaerobic Digestion





Operations

| Technology Type | | | O&M Cost (\$/ton) Low | O&M Cost (\$/ton) High | Time to Finish | Time to Finish (incl. curing) |
|---|--------------------------|--|-----------------------|------------------------|----------------|-------------------------------|
| Aerobic | | | | | | |
| Open Air | Agitated Pile (Windrow) | | \$25/ton | \$52/ton | 90 days | 6-12 months |
| | Aerated Static Pile | | \$13/ton | \$25/ton | 60 days | 4-12 months |
| Enclosed | Agitated Bed and Vessels | Horizontal Bays with top-rail agitator | \$34/ton | \$60/ton | 21 days | 2-4 months |
| | | Containers (worm bins, earth tubs) | \$20/ton | \$50/ton | 7 days | 2-4 months |
| | Aerated Static Pile | Non-Rigid (Plastic or Fabric "Bags") | \$25/ton | \$50/ton | 60 days | 4-6 months |
| | | Rigid (tunnel, bunker, vessel) | \$50/ton | \$150/ton | 14 days | 4-12 months |
| | Rotating Drums | | \$25/ton | \$55/ton | 7 days | 2-4 months |
| | Anaerobic | | | | | |
| Anaerobic Digestion (container or vessel) | | | \$50/ton | \$100/ton | 30 days | 2-3 months |
| Anaerobic Digestion (silo/tank) | | | \$50/ton | \$150/ton | 30 days | 2-3 months |



Operations



Operations

| Technology Type | | | Minimum Volume | Maximum Volume |
|---|--------------------------|--|----------------|----------------|
| Aerobic | | | | |
| Open Air | Agitated Pile (Windrow) | | 10 tons/day | 200 tons/day |
| | Aerated Static Pile | | 1 tons/day | 20 tons/day |
| Enclosed | Agitated Bed and Vessels | Horizontal Bays with top-rail agitator | 5 tons/day | 500 tons/day |
| | | Containers (worm bins, earth tubs) | 1 lbs/day | 20 lbs/day |
| | Aerated Static Pile | Non-Rigid (Plastic or Fabric "Bags") | 0.5 tons/day | 800 tons/day |
| | | Rigid (tunnel, bunker, vessel) | 2.0 tons/day | 800 tons/day |
| | | Rotating Drums | 0.5 tons/day | 1200 tons/day |
| | Anaerobic | | | |
| Anaerobic Digestion (container or vessel) | | | 500 gal/day | 40000 gal/day |
| Anaerobic Digestion (silo/tank) | | | 40000 gal/day | 250000 gal/day |



Operations

Process Monitoring and Control



Operations

Common Parameters

❖ **Temperature**

- ❖ **Primary indicator of microbial activity**
- ❖ **Issues with $<70^{\circ}\text{F}$ and $>160^{\circ}\text{F}$**

❖ **Moisture**

- ❖ **“Squeeze Method” – a few drops only**
- ❖ **Oven methods**

❖ **Oxygen**

- ❖ **Similar assessment of composting rate as T**



Operations

Process Monitoring and Control

- ❖ **Implement Quality Assurance/ Quality Control standards and program**
- ❖ **Perform process monitoring to verify:**
 - ❖ **Product safety standards**
 - ❖ **Product market specs/ standards**
 - ❖ **Process control**
 - ❖ **Regulatory compliance**
- ❖ **Develop and implement site monitoring and sampling plan**
- ❖ **Field and laboratory analysis**
- ❖ **Develop a site Contingency Plan**





Operations

Health and Safety





Operations

Health Concerns

- ❖ **Dust: inhalation, eye irritants, airborne contaminants**
- ❖ **Noise: hearing loss**
- ❖ **Heavy equipment and machinery: loss of limb or life, electrocution, thrown objects**
- ❖ **Heat: exhaustion**



Operations

Safety

- ❖ **Minimizing the risks**
 - ❖ **Pick the right site and equipment**
 - ❖ **Provide Personal Protective Equipment (PPE)**
 - ❖ **Maintain a good housekeeping program**
- ❖ **Safety in compost production**
 - ❖ **Operate equipment appropriately**
 - ❖ **Train and communicate with personnel**



Operations

Occupational Safety & Health Administration (OSHA)

- ❖ **www.osha.gov**
- ❖ **Compliance acceptance**
- ❖ **Laws & regulations**
- ❖ **Enforcement**
- ❖ **State programs**



Operations

Fires

- ❖ **Compost is readily available fuel source**
- ❖ **Typical compost materials ignite when**
 - ❖ **Moisture content <40%**
 - ❖ **Just enough oxygen present (vent holes)**
 - ❖ **Usually in large mass piles**
- ❖ **Ignition source**
 - ❖ **Mechanical (sparks, equipment, cigarette)**
 - ❖ **Biological (uncontrolled microbial activity)**
 - ❖ **Temps >158-176F spontaneous combustion occurs**
- ❖ **Develop fire prevention plan (w/ local fire department)**



Operations

Contaminants

- ❖ **Develop a feedstock questionnaire**
 - ❖ **Visit feedstock generators**
 - ❖ **Pre-test feedstock sources**
- ❖ **Post signs**
- ❖ **Track all incoming feedstock by load**
- ❖ **Visually inspect loads as they are received**
- ❖ **Charge addition fees for contamination**
- ❖ **If possible, remove contaminants before processing**



Operations

Equipment Selection and Maintenance



Operations

Equipment Selection

Considerations

- ❖ Production
- ❖ Simplicity of operation & maintenance
- ❖ Product support
- ❖ Durability
- ❖ Relationship with manufacturer

Considerations

- ❖ Price
- ❖ Safety
- ❖ Reliability
- ❖ References
- ❖ Reputation

Know your Waste!



Operations

Equipment Categories

- ❖ **Pre process equipment**
 - ❖ Weigh scales
 - ❖ Grinding equipment
 - ❖ Mixing equipment
 - ❖ Loading/ material handling equipment
- ❖ **In process equipment**
 - ❖ Compost turners/ loaders
 - ❖ Moisture management equipment
 - ❖ Aeration equipment
 - ❖ Process management equipment
- ❖ **Post process equipment**
 - ❖ Screening equipment
 - ❖ Bagging equipment



Operations

Price Variations

- ❖ **Turning Equipment**
 - ❖ Loaders = \$50K-\$300K
 - ❖ Tractor-driven Turners = \$40K-\$200K
 - ❖ Self-propelled Turners = \$40K-\$600K
- ❖ **Grinding/Chipping**
 - ❖ Grinders = \$20K-\$700K
 - ❖ Hammer Mills = \$17K-\$400K
 - ❖ Chippers/Shredders = \$5K-\$300K
- ❖ **Mixing**
 - ❖ Pug Mills = \$20K-\$200K
 - ❖ Batch Mixers = \$10K-\$350K
- ❖ **Screening**
 - ❖ Screeners = \$50K-\$500K



Operations

Maintenance

- ❖ **House Keeping**
 - ❖ **Appearance of grounds and structures**
- ❖ **Equipment**
 - ❖ **Follow vendor O&Ms**
 - ❖ **Preventative maintenance schedules**
 - ❖ **Record keeping**
 - ❖ **Computerized tracking and inventory**

CONTINGENCY!



Operations

Staffing



Operations

Staffing

- ❖ **Small pool of skilled *composters***
 - ❖ **Large equipment operators and farmers**
- ❖ **Need mechanical skill and high attention to detail**
- ❖ **Large expense is operations and making sure all tasks are run efficiently**
- ❖ **Need to make sure all equipment is operational with minimal downtime**
- ❖ **Mix of full- and part-time staff**
- ❖ **Training vital**



Operations

Staff Training

- ❖ **Composting 101**
- ❖ **Let ALL employees understand importance and effect of every step!**
- ❖ **Site health and safety, and security**
- ❖ **Duty/ equipment specific**
- ❖ **Other aspects as well**
- ❖ **Operations and maintenance**
- ❖ **Proper reporting/ record keeping**



Operations

Staff Management

- ❖ **Administer training**
 - ❖ **Initial**
 - ❖ **On-going**
- ❖ **Certification up-keep**
- ❖ **Seminars/Conferences**
- ❖ **Schedules and seasonal needs**
- ❖ **Mix roles (for covering...do not want back-up!)**
- ❖ **Lead by example**



Operations

Site Selection and Community Relations





Operations

Siting

- ❖ The most critical issue in facility development
- ❖ Need 2-5xs the land you need for facility
- ❖ Try for >1,000' to any sensitive receptors
 - ❖ Houses, churches, shopping centers, etc.
 - ❖ Surround facility with wooded buffers
- ❖ Try to be <5 miles from major arterial roads
- ❖ Acquire necessary permits (state solid waste, ag, water quality, local zoning, etc.)
- ❖ Setbacks!
 - ❖ Environmental, infrastructure (e.g., airports), etc



Operations

Site Selection

❖ Site Location

- ❖ Roads suitable for truck traffic
- ❖ Convenient to source of feedstocks
- ❖ Not in a residential area

❖ Sizing

- ❖ Anticipated volume and equipment needs
- ❖ Future growth

❖ Site Characteristics

- ❖ Level to slightly sloped ground
- ❖ Firm drainable soil
- ❖ Utilities convenient



Operations

Causes of Concern/ Complaints

- ❖ **Ground and surface water pollution**
- ❖ **Property value reduction**
- ❖ **Migration of airborne fungal spores and pathogens**
- ❖ **Odor**
- ❖ **Excessive truck traffic**
- ❖ **Noise**
- ❖ **Vectors: rodents and insects**



Operations

Addressing Concerns/ Complaints

- ❖ **Involve public in site selection and design**
- ❖ **Communication!**
 - ❖ **Hold open meetings**
 - ❖ **Send letters**
 - ❖ **Set-up a hotline and website**
- ❖ **Hold “Open House” tours**
- ❖ **Do not hide what you are doing**



Operations

Michael Nicholson

WeCare Organics, LLC

mnicholson@wecareorganics.com

419-349-5402

cfranklin@wecareorganics.com

315-689-1937